July 16, 1968 F. I. BROWN 3,392,780

APPARATUS FOR TREATING SPECIMENS

Filed April 28, 1964 3 Sheets-Sheet 1

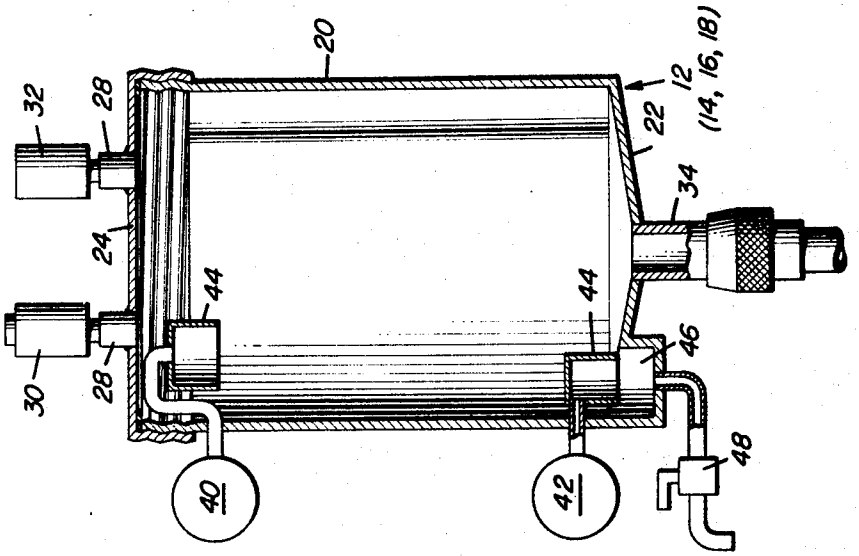


Fig. 1

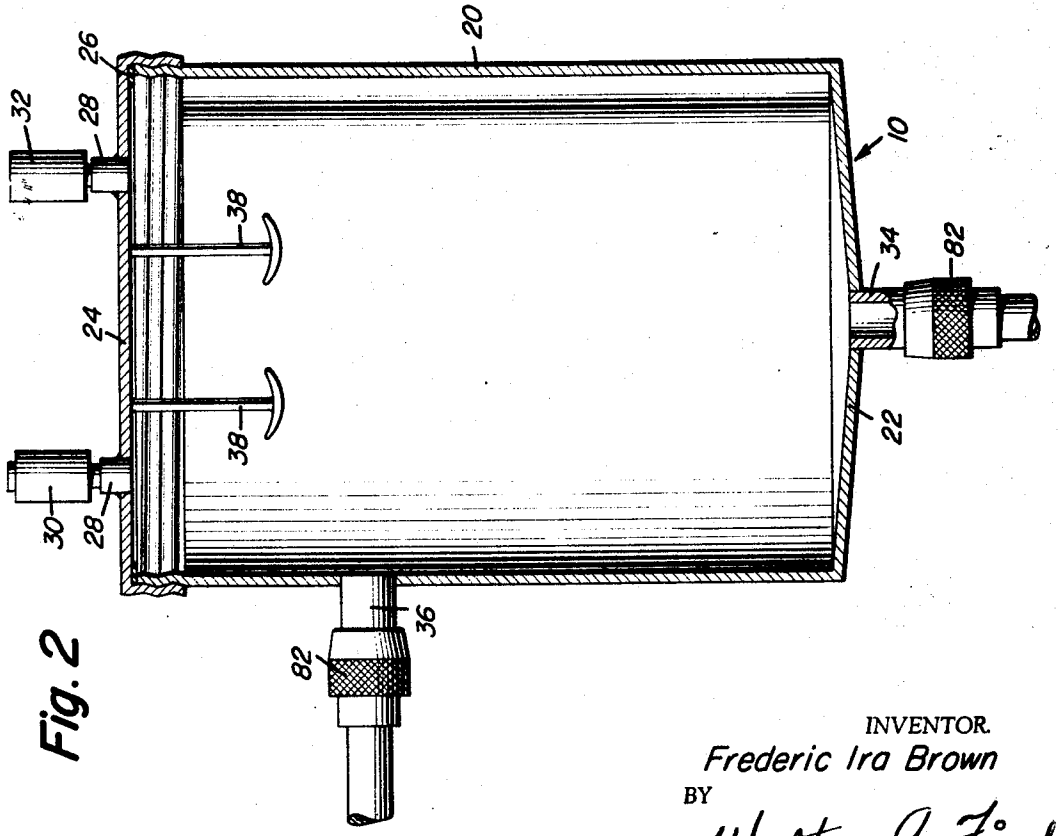


Fig. 2

INVENTOR.
Frederic Ira Brown
BY
Walter J. Finch
ATTORNEY

July 16, 1968 F. I. BROWN 3,392,780

APPARATUS FOR TREATING SPECIMENS

Filed April 28, 1964 3 Sheets-Sheet 2

Fig. 3

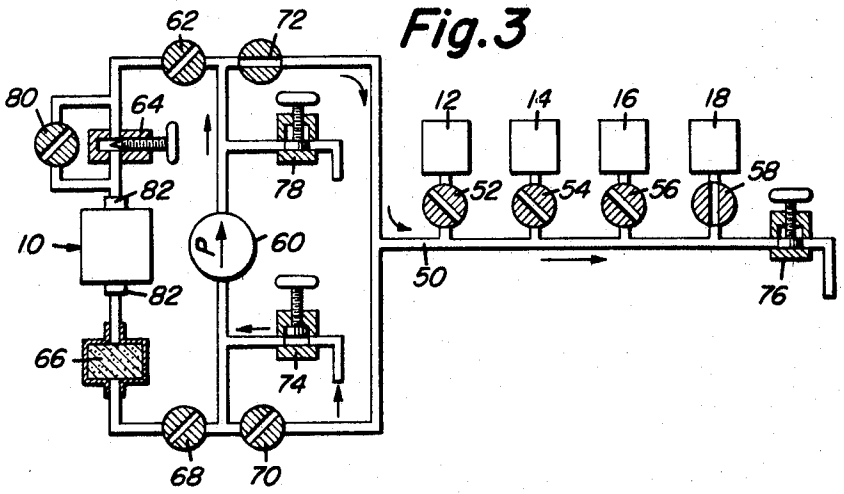


Fig. 4

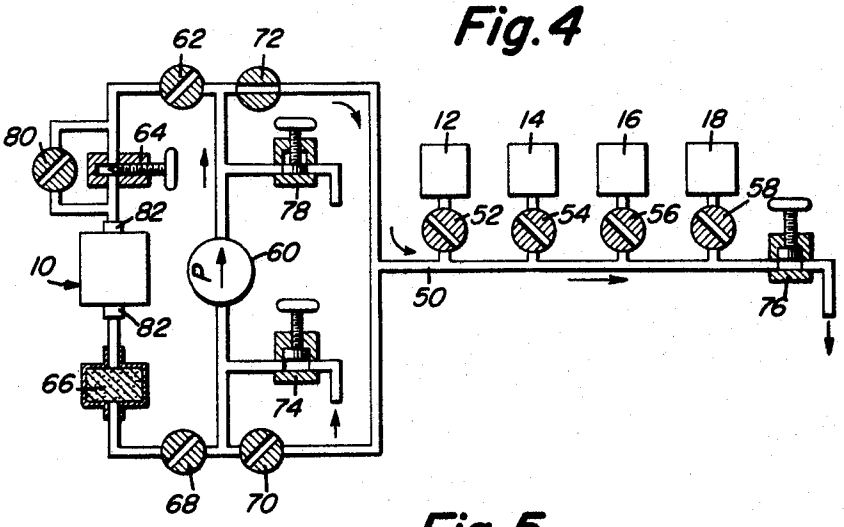
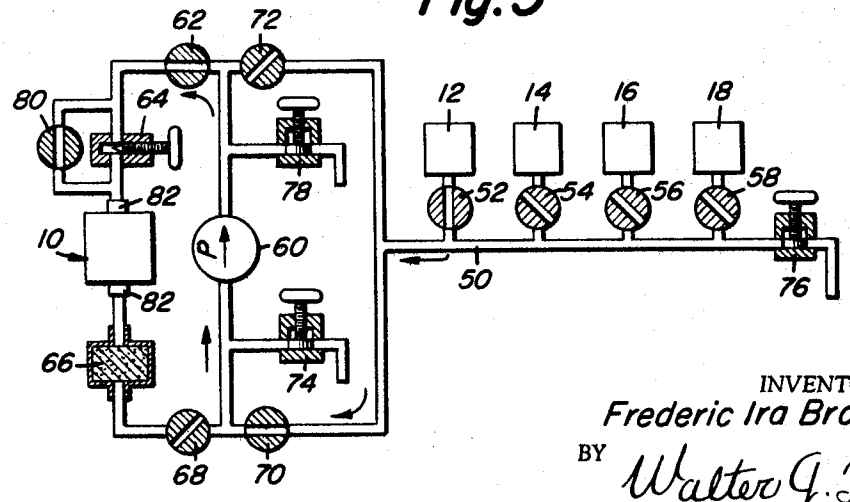


Fig. 5



INVENTOR.
Frederic Ira Brown
BY Walter J. Finch
ATTORNEY

July 16, 1968 F. I. BROWN 3,392,780

APPARATUS FOR TREATING SPECIMENS

Filed April 28, 1964 3 Sheets-Sheet 3

Fig. 6

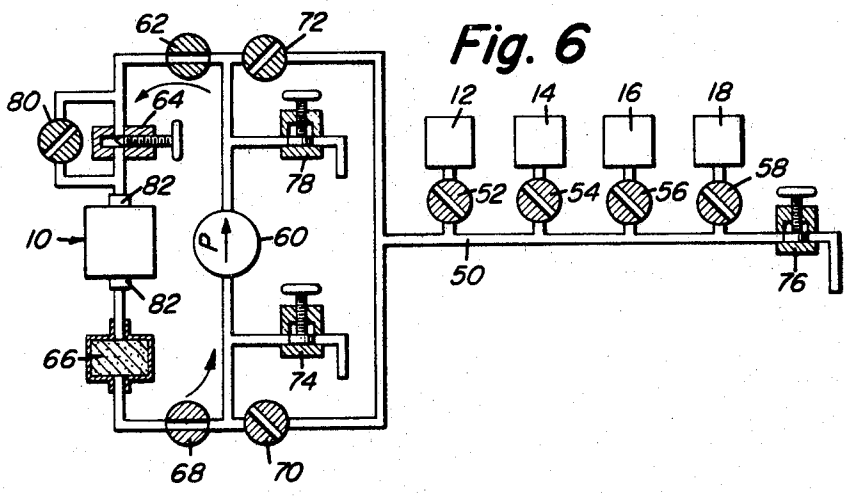


Fig. 7

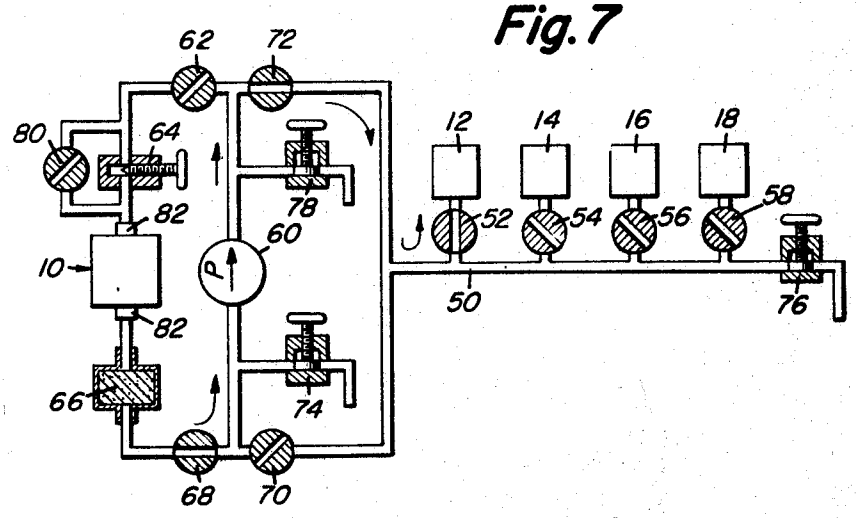
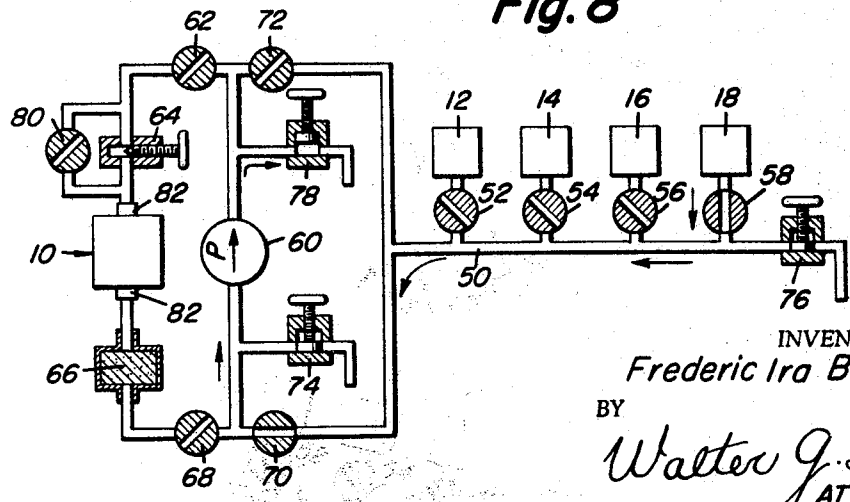


Fig. 8



INVENTOR.
Frederic Ira Brown
BY
Walter J. Finch
ATTORNEY

United States Patent Office 3,392,780 Patented July 16, 1968

3,392,780

APPARATUS FOR TREATING SPECIMENS

Frederic Ira Brown, 2802 Munster Road, Baltimore, Md. 21234

Filed Apr. 28, 1964, Ser. No. 363,247
2 Claims. (Cl. 118—429)

ABSTRACT OF THE DISCLOSURE

Apparatus is provided for treating a specimen with a plurality of liquids sequentially, the apparatus comprising a container for holding the object, a plurality of other containers for holding the liquids separately, a pump for circulating a liquid through the object holding container, a by pass valve arrangement to enable the object holding container to be filled more rapidly than circulating flow of liquid, and another valve arrangement for controlling the flow of liquid selectively from the other containers to the object holding container.

This invention relates to automatic immersion apparatus, and more particularly to methods and apparatus for treating and processing specimens, such as tissue.

In the processing of tissue specimens for mounting in plastic, di-, tri-, tetra-nitrates of cellulose or paraffin and the like or for subsequent examination under a microscope it is necessary that the resulting product be completely treated and yet retain its original shape. The technic involves fixing, decalcifying, dehydrating, clearing and infiltrating with a media. Various chemicals in sequence are used and some of the processes are very lengthy and tedious. Generally the specimens are large, gross or delicate and cannot be long exposed to air. The chemicals often are explosive or hazardous to personnel. For these reasons the older processes involving transfer of the specimen from container to container leaves much to be desired from a standpoint of perfection, efficiency and safety especially in routine work.

It is accordingly an object of the present invention to provide an apparatus for processing a specimen with the least possible exposure to air and with the least handling or movement of specimen during procedure.

Another object of this invention is to provide an arrangement for histological technic which will process specimens in less time than heretofore and which will operate manually or automatically.

An arrangement of apparatus for chemical treatment of specimens which preserves the chemical from undue exposure to air and allows its reuse several times is still another object.

An explosion proof and non-hazardous apparatus for handling the chemicals in a processing apparatus for tissue preparation is yet another objective.

Still another object of this invention is to provide an immersion apparatus which will handle practically any desired immersing or treating chemicals including those requiring sub or super pressures and/or temperatures in any sequence desired.

Other objects and attendant advantages will become more readily apparent and understood from the accompanfing specification and drawings in which:

FIG. 1 is a vertical section view of a supply tank for use with the invention;

FIG. 2 is a vertical section view of the circulating tank;

FIG. 3 is a schematic diagram of the hydraulic system of the invention with flow arrows indicating the condition of loading a supply tank;

FIG. 4 is a schematic similar to FIG. 3 illustrating the flow during a pump and manifold flushing operation;

FIG. 5 is a schematic similar to FIG. 3 illustrating a charging operation of the circulating tank;

FIG. 6 is a schematic illustrating the circulation made of the system;

FIG. 7 illustrates the discharging of the circulating tank; and

FIG. 8 shows the unloading of a supply tank.

This apparatus comprises one treating or circulating tank **10** and a plurality of reservoir or supply tanks **12, 14, 16, 18**, etc. as many as required for the different chemicals to be used. All the tanks are generally alike structurally, having a cylindrical side wall **20** and a tapering bottom **22** secured together as one piece.

A removable cover or top **24** is provided for each tank and arranged to be secured to the latter by clamp means or threading and be hermetically tight with an intervening gasket or compressible washer **26**.

Each top is provided with a pair of threaded nipples **28** and one of these nipples mounts a pressure relief valve **30**. The other nipple of each pair mounts a vacuum breaker **32**.

At the deepest point of all tanks there is provided a pipe connection nipple **34** on the bottom **22**. This nipple **34** is both inlet and outlet for the reservoir or supply tanks **12, 14, 16, 18**. It is the outlet only in the case of the treating or circulating tank **10**.

The inlet for the circulating tank **10** is provided by a nipple **36** near the top of the side wall **20**.

One or more hooks **38** depend into the circulating tank **10** from its top **24** as specimen supports.

A pair of pressure switches **40** and **42** are mounted through the sidewall **20** of each supply tank **12, 14, 16, 18** each switch communicating inside to a pressure sampling inverted cup **44**. When liquid rises around the cup **44** it closes the mouth thereof and compresses the atmosphere inside to thus actuate the pressure switches **40** or **42**. These cups **44** are positioned so as to signal the full tank by the uppermost pressure switch **40** and an empty tank by the lowermost switch **42**. The lowermost cup **44** is in a small well **46** in the bottom **22** of the tank. A petcock **48** is provided to drain this well **46** whenever it is desired to change the chemical fluid to another.

The circulating tank **10** is the largest since it is required to hold a specimen for treatment as well as one supply tank-full or charge of chemical.

The pressure valve and vacuum breaker **30** and **32** respectively are usually set for a differential of ten ounces per square inch pressure that is, five ounces plus and minus atmospheric level. Thusly the tanks can be filled or emptied without a large buildup of pressure or vacuum and yet are essentially closed vessels.

As best shown in FIG. 3 the supply tanks **12, 14, 16, 18** all communicate with a common pipe or manifold **50** through individual electrically operated tank valves **52, 54, 56, 58**. More supply tanks and associated valves may be added as required by the user.

The circulating tank **10** is in a circulating system comprising from the outlet of an electrically driven pump **60**; an electrically operated upper valve **62**, a manual needle valve **64**, the circulating tank **10** (with specimen), an in-line filter **66** and a return valve **68** (also electric) all in series back to the inlet of pump **60**.

The manifold **50** branches at one end, one branch to connect to the inlet of pump **60** through an electrically operated charging valve **70** and the other branch to the outlet of pump **60** through an electrically operated discharging valve **72**.

The various chemicals are introduced to the apparatus initially through a stop cock **74** connected to the inlet of pump **60**. The tanks **12, 14, 16, 18** are drained, by

means of another stop cock **78** attached to the pump outlet. The system is flushed by drawing water or other solvents in at the stop cock **74** and releasing it through a third stop cock **76** on the end of manifold **50**.

The needle valve **64** is shunted with an electrically controlled bypass valve **80** which when opened serves to speed the filling of tank **10** when charging it with fluid prior to a circulation period.

It will be noted that the valves **62** and **72** operate together, one opening when the other closes. The same is true for valve **68** versus valves **70** and **80**.

An important feature is the provision of quick disconnects **82** to the inlet and to the outlet of the circulating tank **10**. These disconnects **82** are of the type which close off both the line and tank when the tank is removed. Accordingly the circulating tank **10** can be removed from the system for loading on a bench top. Thus a specimen can be loaded or unloaded while the various chemical fluids are being introduced to the supply tanks **12, 14, 16, 18.**

Six basic operations are provided for by the positioning of the electric valves and/or the manual stop cocks. These operations are:

A. Loading a supply tank (FIG. 3),
B. Flushing pump and manifold (FIG. 4),
C. Charging circulating tank (FIG. 5),
D. Circulating circulating tank (FIG. 6),
E. Discharging circulating tank (FIG. 7),
F. Unloading a supply tank (FIG. 8).

The operations A, B, and F are necessarily manual. The operations C, D, and E are either manual or automatically sequenced by means of a suitable timer programmer switch. The pressure switches **40** and **42** for the supply tanks **12, 14, 16, 18** are interlocked electrically with their respective electric valves **52, 54, 56, 58** so it is impossible to overfill them.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. Apparatus for the sequential treatment of an object with fluids, comprising first means for containing said object, a plurality of second means for containing said fluids, means including a common line for sequentially supplying said fluids from said plurality of second means to said first means for sequentially treating said object, means including a pump having an inlet and outlet communicating with said first means for circulating said fluids when supplied to said first means, first valve means positioned between said outlet and said first means for limiting the flow of said fluids therebetween, and second valve means positioned to bypass said first valve means during the filling of said first means with fluid.

2. Apparatus for the sequential treatment of an object with liquids, comprising a first container for containing said object, a plurality of second containers for containing said liquids, means including a pump having an inlet and outlet communicating with said first container for circulating said liquids when supplied to said first container, first valve means positioned between said outlet and said first container for limiting the flow of said liquids therebetween, second valve means positioned to bypass said first valve means during the filling of said first container with liquid, means for sequentially supplying said liquids from said second containers to said pump, and third valve means for controlling the flow of said liquids between said first container and said second containers.

References Cited

UNITED STATES PATENTS

2,966,922	1/1961	Wallis	137—266 X
3,010,847	11/1961	Ewing et al.	118—429 X
3,227,130	1/1966	Weiskopf	118—50 X

CHARLES A. WILLMUTH, *Primary Examiner.*
J. P. McINTOSH, *Assistant Examiner.*